1996
HABITAT AND MACROINVERTEBRATE SURVEY

EAST FORK BIG SPRING CREEK AND BEAVER CREEK, FERGUS COUNTY, MONTANA

prepared for
Fergus County Conservation District
and
Montana Department of Environmental Quality

prepared by
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Introduction

Aquatic macroinvertebrate and habitat surveys were conducted for the first time at two sites in East Fork Big Spring Creek and at one site in Beaver Creek, a tributary of East Fork Big Spring Creek, in August 1996. Both streams are located in Fergus County, Montana. This report presents the data from these surveys and establishes baseline biotic conditions against which future surveys may be compared. Reference is also made to a single previous evaluation of a site in East Fork Big Spring Creek, near its mouth, which was part of a study of Big Spring Creek (McGuire 1995) to which the East Fork is tributary. The analysis of macroinvertebrate communities and their relationship to habitat condition can help direct management practices toward improving streams' biological health, or integrity, defined by Karr and Dudley (1981) as "the capability of supporting and maintaining a balanced, integrated, adaptive community of organisms having a species composition, diversity and functional organization comparable to that of natural habitat of the region."

Methods

Benthic macroinvertebrate sampling was performed by personnel of the Montana Department of Environmental Quality (DEQ) on August 28, 1996. The traveling kick-net method described by Bukantis (1996) was utilized. Two samples were collected from each of three riffled reaches; the resulting six samples were numbered and sites described as follows:

1.1 and 1.2 from East Fork Big Spring Creek at Comes' riparian enclosure
2.1 and 2.2 from East Fork Big Spring Creek at Comes', 100 feet below bridge
3.1 and 3.2 from Beaver Creek at Regli's.

In addition to macroinvertebrate sampling, nine habitat parameters were scored for quality using a DEQ-modified version of the US EPA Rapid Bioassessment Protocols (RBP) for habitat assessment (Plafkin et al. 1989). Habitat parameters evaluated include instream features, bank and riparian condition.

In the laboratory, the RBP III sorting method was used to obtain subsamples of approximately 300-350 organisms from each of the six samples. The organisms were identified to taxonomic levels appropriate to RBP III analysis, usually genus or species. Guidelines for taxonomic work provided by Bukantis (1996) were followed. Community structure, function and sensitivity to impact were characterized for each subsample using the battery of eight metrics recommended by DEQ for streams of the Montana Valley and Foothill Prairies Ecoregion. An internal reference approach was used in the analysis of biotic condition for East Fork Big Spring Creek sites: a reference value for each metric was established for all study sites (two surveyed in 1996 and one surveyed in 1994) based on the performance of that metric at all East Fork sites. With a few exceptions, the best value was chosen as the point of comparison, or reference value, for each metric used.

Because only four samples from 1996 and two samples from the near-mouth site taken in 1994 were available, reference values used in the assessment of East Fork Big Spring Creek sites are tentative, and evaluation should be considered preliminary until more data can be gathered to contribute to the study of this stream. The limited number of samples presented some problems in the establishment of reference values for some metrics. For example, the near-mouth site, sampled in 1994, yielded the "best" value for the taxa richness metric; 46 taxa were collected in a single

replicate sample at that site. Yet this value was not used as the reference point, since taxa richness increases along a stream's longitudinal gradient, and such a high value would probably be inappropriate for comparison to upstream sites. Similar rationales governed the choice of reference values for the percent EPT and the percent dominant taxon metrics. In addition, the biotic index reference value, which is intended to represent "best" conditions in the stream, is considerably higher than would be expected in "natural habitat of the region", and in fact indicates a community quite tolerant to nutrient or organic enrichment.

Since no previous survey of any site on Beaver Creek was available, preliminary evaluation of the site at Regli's was based on reference values established by DEQ for the Montana Valleys and Foothill Prairies Ecoregion. Future surveys of Beaver Creek would allow development of internal reference values for this stream, and more meaningful assessment of biotic conditions.

Actual metric values for the two samples taken at each site were averaged and the mean value was compared to the reference value to obtain metric scores. Total metric scores were obtained by summing scores for all metrics, and a water quality use support rating for each site was derived from this total score.

Results and Discussion

Habitat assessment

Table 2 shows scores of individual habitat parameters, total scores and habitat condition classifications, and the criteria by which classifications were assigned.

East Fork Big Spring Creek

Habitat at the East Fork site within the riparian enclosure was rated as optimal, while that at the site outside the enclosure was rated sub-optimal. Poor bank vegetative cover and marginal bank stability possibly contributed to the instream impacts outside the enclosure; some degree of increased substrate embeddedness and fine sediment was noted. In addition, riparian width was perceived to be poor at that site. Within the enclosure, riparian width was perceived to be sub-optimal, but instream characteristics rated optimal scores.

Habitat at the near-mouth East Fork site evaluated in 1994 was classified at that time as sub-optimal. Channel alteration, sediment deposition and marginal bank conditions were identified as limitations to habitat quality (McGuire 1995).

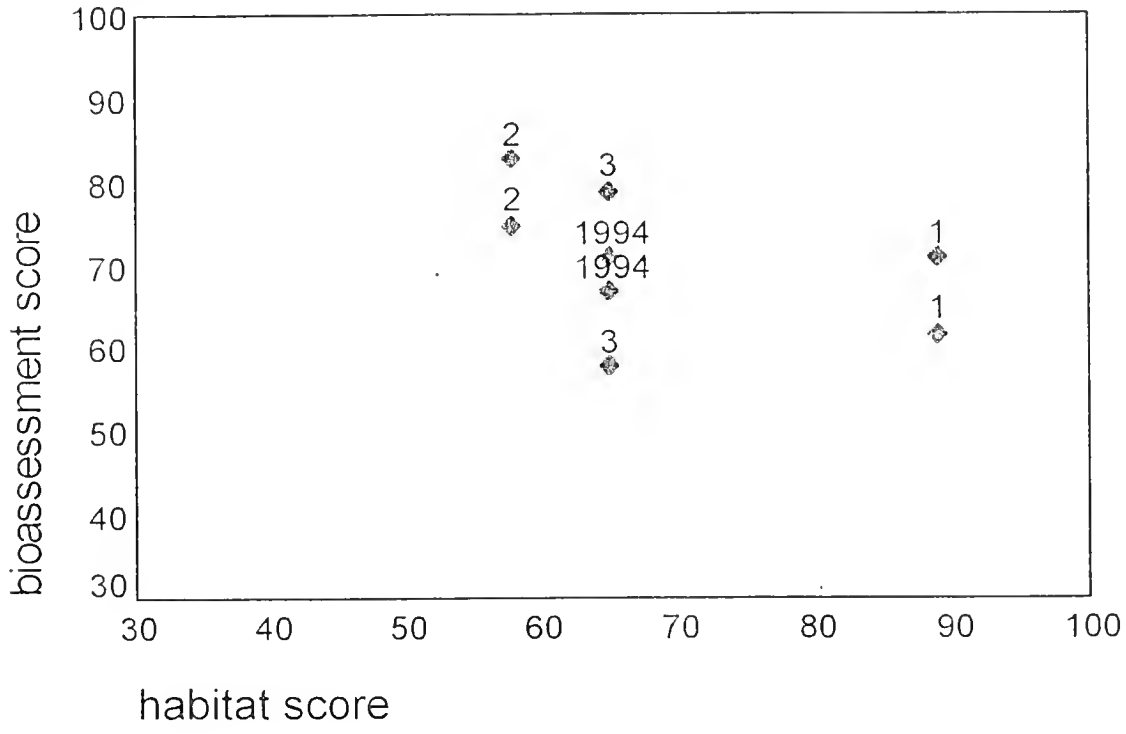
Beaver Creek

Habitat at the Beaver Creek site was rated sub-optimal, with marginal bank stability and bank vegetative cover. Some sediment deposition and substrate embeddedness was noted. A sub-optimal score was assigned to riparian width.

Macroinvertebrate communities

Macroinvertebrate taxa lists, metric results and other information for each replicate taken in the 1996 survey are given in the Appendix. Figure 1 illustrates the relationship between bioassessment scores and habitat scores for replicates taken in both 1996 and 1994.

Figure 1: Bioassessment scores vs. habitat scores for East Fork Big Spring Creek and Beaver Creek. August 28, 1996 and August, 1994.



1 = East Fork Big Spring Creek at Comes', within riparian enclosure
2 = East Fork Big Spring Creek at Comes', below bridge
3 =Beaver Creek at Regli's
1994 =East Fork Big Spring Creek near mouth, sampled in 1994.

East Fork Big Spring Creek

The percent similarity between replicates was 74% for those taken within the riparian exclosure and 68% for those taken outside the enclosure.

Macroinvertebrate assemblages at both East Fork sites were dominated by sediment-tolerant taxa including the caddisfly *Hydropsyche* spp., the snail *Physella* sp and the elmid beetle *Optioservus* sp. Filter-feeding organisms comprised about 30% of both communities, strongly suggesting that organic and/or nutrient enrichment has compromised the biotic health at these sites

Interestingly, the biotic community outside the riparian enclosure scored higher for biotic integrity than did the site within. Optimal habitat assessment coupled with a partial support use classification (indicating slight impairment of biotic integrity) at the enclosed site suggests that water quality degradation has limited the benthic community here. In Figure 1, the enclosed site illustrates the characteristic relationship between habitat and bioassessment scores when water

quality impairment is impacting biointegrity. Below the bridge, the site outside the enclosure scored sub-optimally for habitat quality, but received a full support classification (indicating no impairment of biotic integrity). Metrics which showed significant differences between the two sites included the percent collectors and the percent Hydropsychinae of Trichoptera. Collectors were indeed less abundant at the site outside the enclosure, but the difference was due to a decrease in the numbers of gathering-collectors, while filtering-collectors were just as abundant here as at the enclosed site. And, while the proportion of net-spinning hydropsychid caddisflies was less at the site outside the exclosure, these filtering organisms were simply replaced by other filter-feeders, including *Brachycentrus occidentalis*, at this site. Water quality degradation, including organic and/or nutrient enrichment appears to be a problem at both East Fork Big Spring Creek sites despite the full support classification assigned to the below-bridge site in this preliminary assessment.

Beaver Creek

The percent similarity between Beaver Creek replicate samples was 65%. The macroinvertebrate community at the sampled site was dominated by the sediment-tolerant filter-feeding caddisfly *Hydropsyche* sp., but the perlodid stonefly *Skwala* sp. was abundant as well, comprising 33% of combined replicates. Large numbers of this predator likely indicate good habitat diversity and potential. Still, based on its mean metric scores, the site rated a partial support classification (biotic integrity was slightly impaired), because of low numbers of EPT taxa and shredders and scrapers compared to the ecoregional reference community. Bioassessment scores for the individual replicate samples taken at this site were dissimilar (see Figure 1), adding uncertainty to the evaluation. Sediment deposition does appear to have limited the macroinvertebrate community at the Beaver Creek site, but a more informative analysis would be possible if more surveys were performed and a more relevant reference community established for this stream.

Conclusions

- Organic and/or nutrient impacts to water quality impaired the biotic health of the reach of East Fork Big Spring Creek within the riparian enclosure. Habitat quality was perceived to be optimal at this site.
- Habitat degradation which resulted in sediment deposition has impaired biotic integrity of the reach of East Fork Big Spring Creek outside of the riparian enclosure. Marginal streambank stability and vegetative cover, and poor riparian width are potential causes or contributing factors. Organic and/or nutrient impacts to water quality were evident at this site as well.
- Sediment deposition has impaired the biotic community in the sampled reach of Beaver Creek. Marginal bank stability and vegetative cover, and sub-optimal riparian width could contribute to the problem.
- Bioassessment based on reference values for East Fork Big Spring Creek and Beaver Creek established by the limited survey reported herein should be considered preliminary. More informative evaluations could result from sampling additional sites in these streams and by an effort to establish more reasonable reference conditions against which to compare sampled sites.

Tables

Table 1. Internal reference values and criteria for assigning scores to metrics based on percent comparability to reference values (adapted from McGuire 1995): East Fork Big Spring Creek, 1996.

metric	East Fork Big Spring Creek reference	Scoring Criteria				*
		6	4	2	0	
Taxa richness	29	> 80%	80-60%	60-40%	< 40%	a
EPT richness	20	> 85%	85-70%	70-50%	< 50%	a
Biotic index	4.77	> 90%	90-80%	80-70%	< 70%	b
% dominant taxon	24	> 60%	60-45%	45-30%	< 30%	b
% Collector: g + f	46	> 90%	90-80%	80-70%	< 70%	b
% Scraper +Shredder	40	> 80%	80-60%	60-40%	< 40%	a
% EPT	50	> 75%	75-50%	50-25%	< 25%	a
% Hydropsych. of Trichop.	na	< 50%	50-70%	70-90%	>90%	c

* a = score is ratio of study site to reference x 100.
* b = score is ratio of reference to study site x 100.
* c = score is based on the actual value, not a percentage of reference.

Table 2. Montana Valleys and Foothill Prairies Ecoregion: Reference values for macroinvertebrate metrics and scoring criteria. (From Bukantis 1996.)

	Scoring criteria			
metric	6	4	2	0
Taxa richness	>28	28 - 21	21 -14	<14
EPT richness	>14	14 - 13	12 - 11	<11
Biotic index	<4	4 - 5	5 - 6	>6
% dominant taxon	<30	30 - 40	40 - 50	>50
% Collector: g + f	<60	60 - 75	75 - 90	>90
% Scraper + Shredder	>30	30 - 20	20 - 10	<10
% EPT	>60	60 - 45	45 - 30	<30
% Hydropsych. of Trichop	<75	75 - 85	85 - 95	>95

Table 3. Stream and riparian habitat assessment: East Fork Big Spring Creek drainage: August 28, 1996.

Location:	At Comes': riparian enclosure	At Comes': 100 ft.below bridge	Beaver Creek at Regli's
Parameter			
riffle development	10	10	9
substrate development	10	8	9
embeddedness	18	14	14
channel alteration	16	16	13
sediment deposition	16	12	14
flow status	19	19	17
bank stability (right/left)	10 / 10	5 / 5	3 / 3
bank vegetative cover (right/left)	10 / 10	2 / 2	5 / 5
riparian width (right/left)	7 / 6	0 / 0	6 / 6
9 parameters (160 maximum)			
total score	142	93	104
% of maximum	89	58	65
classification	OPTIMAL	SUB-OPTIMAL	SUB-OPTIMAL

Categories:
(% of total): Optimal >81; Sub-optimal 75-56; Marginal 49-29; Poor <23

Table 4. Water quality use support/ standards violation thresholds. (From Bukantis 1996.)

Percent of reference	Support rating
>75	Full support--standards not violated
25-75	Partial support--moderate biotic impairment--standards violated
<25	Non-support--severe biotic impairment--standards violated

Table 5. Mean Metric values, percentage of reference and bioassessments for East Fork Big Spring Creek drainage: August 28, 1996 and August, 1994.

Metric	At Comes' riparian enclosure	At Comes' 100 ft. below bridge	Near mouth August 1994
Taxa richness	28	28	43
EPT richness	11	12	18
Biotic index	5.35	5.14	4.80
% dominant taxon	25	26	11
% Collector: g + f	61	46	85
% Scrapers + Shredders	31	39	6
% EPT	44	41	53
% Hydropsychinae of Trichoptera	78	42	59
% of reference			
Taxa richness	97	97	100
EPT richness	55	60	90
Biotic index	89	93	99
% dominant taxon	96	92	100
% Collector: g + f	75	100	54
% Scrapers + Shredders	78	98	15
% EPT	88	82	100
% Hydropsychinae of Trichoptera	na	na	na
metric score			
Taxa richness	6	6	6
EPT richness	2	2	6
Biotic index	4	6	6
% dominant taxon	6	6	6
% Collector: g + f	2	6	0
% Scrapers + Shredders	4	6	0
% EPT	6	6	6
% Hydropsychinae of Trichoptera	2	6	4
total score	32	44	34
% reference	67	92	71
classification*	Partial support	Full support	Partial support

* See Table 4.

Table 6. Mean metric values and bioassessment for Beaver Creek, using the Montana Valleys and Foothill Prairies ecoregional reference. (See Table 2.) August 28, 1996.

metric	Beaver Creek at Regli's
Taxa richness	30
EPT richness	10
Biotic index	4.52
% dominant taxon	24
% Collector: g + f	62
% Scrapers + Shredders	14
% EPT	56
% Hydropsychinae of Trichoptera	66
metric score	
Taxa richness	6
EPT richness	0
Biotic index	4
% dominant taxon	6
% Collector: g + f	4
% Scrapers + Shredders	2
% EPT	4
% Hydropsychinae of Trichoptera	6
total score	32
percent of maximum	67
classification*	Partial support

* See table 4

Literature cited

Bukantis, Bob. 1996. Rapid bioassessment macroinvertebrate protocols: sampling and sample analysis SOP's. Montana Department of Environmental Quality. Water Quality Division. Working draft.

Karr, JR and DR Dudley. 1981. Ecological perspective on water quality goals. *Environmental Management*. 11:249-256.

McGuire, Daniel L. Big Spring creek: 1994 Aquatic macroinvertebrate and habitat survey. Report prepared for the Montana Department of Health and Environmental Sciences and Fergus County Conservation District.

Plafkin, JL, MT Barbour, KD Porter and SK Gross. 1989. Rapid Bioassessment Protocols for Use in Streams and Rivers. Benthic Macroinvertebrates and Fish. U.S. EPA. 444/ 4-89-001.

APPENDIX

Macroinvertebrate Taxonomic Data

EAST FORK BIG SPRING CREEK

At Comes' riparian enclosure	1.1		1.2			
Taxon	#	%	#	%	BI[2]	FFG[1]
MISC. TAXA						
Oligochaeta: Enchytraeidae	0	0	2	0.59	4	CG
Oligochaeta: Naididae	0	0	1	0.29	8	PR
Physella sp.	83	24.20	47	13.86	8	SC
Acari	1	0.29	0	0	5	PA
TOTAL: MISC. TAXA	84	24.49	50	14.75		
ODONATA						
Ophiogomphus	4	1.17	0	0	5	PR
TOTAL: ODONATA	4	1.17	0	0		
EPHEMEROPTERA						
Acentrella sp.	0	0	2	0.59	4	CG
Baetis tricaudatus	27	7.87	12	3.54	4	CG
Tricorythodes minutus	9	2.62	18	5.31	4	CG
TOTAL: EPHEMEROPTERA	36	10.50	32	9.44		
PLECOPTERA						
Zapada cinctipes	0	0	4	1.18	3	SH
Skwala	1	0.29	0	0	3	PR
TOTAL: PLECOPTERA	1	0.29	4	1.18		
TRICHOPTERA						
Brachycentrus occidentalis	9	2.62	12	3.54	2	CF
Helicopsyche borealis	3	0.87	0	0	3	SC
Cheumatopsyche	2	0.58	3	0.88	5	CF
Hydropsyche	84	24.49	88	25.96	5	CF
Hydroptilidae (pupa)	0	0	1	0.29	4	PH
Hydroptila	1	0.29	0	0	6	CG
Ochrotrichia	1	0.29	0	0	4	PH
Nectopsyche sp.	0	0	2	0.59	2	SH
Oecetis	7	2.04	10	2.95	8	PR
Wormaldia	4	1.17	1	0.29	0	CF
TOTAL: TRICHOPTERA	111	32.36	117	34.51		
COLEOPTERA						
Optioservus sp.	42	12.24	28	8.26	5	SC
TOTAL COLEOPTERA	42	12.24	28	8.26		
DIPTERA						
Atherix	3	0.87	6	1.77	5	PR
Empididae (pupa)	1	0.29	0	0	6	PR
Chelifera sp.	0	0	1	0.29	5	PR
Simuliidae (pupa)	1	0.29	0	0	6	CF
Simulium sp.	4	1.17	2	0.59	5	CF
Dicranota	1	0.29	0	0	3	PR
Hexatoma	4	1.17	4	1.18	2	PR
Limnophila	5	1.46	0	0	3	MH

Continued...

Macroinvertebrate Taxonomic Data

EAST FORK BIG SPRING CREEK

At Comes' riparian enclosure	1.1		1.2			
Taxon	#	%	#	%	BI[2]	FFG[1]
Tipula sp.	0	0	3	0.88	4	SH
TOTAL: DIPTERA	19	5.54	16	4.72		
CHIRONOMIDAE						
Cricotopus	10	2.92	14	4.13	7	CG
Eukiefferiella Devonica Gr.	0	0	1	0.29	8	CG
Eukiefferiella Brehmi Gr.	16	4.66	22	6.49	4	CG
Pagastia sp.	0	0	1	0.29	1	CG
Parametriocnemus	3	0.87	5	1.47	5	CG
Rheocricotopus sp.	0	0	4	1.18	4	CG
Rheotanytarsus	2	0.58	4	1.18	6	CF
Thienemannimyia	3	0.87	1	0.29	5	PR
Tvetenia Bavarica Gr.	12	3.50	40	11.80	5	CG
TOTAL: CHIRONOMIDAE	46	13.41	92	27.14		
GRAND TOTAL	343	100.00	339	100.00		

1. Functional feeding group designations are given in Table A.
2. Biotic index scores for individual taxa, as given in Bukantis 1996

Aquatic Macroinvertebrate Data: East Fork Big Spring Creek: At Comes' riparian enclosure.

Sample:	1.1	1.2
% of sample used.	31	75
Subsample size	343	339
Taxa richness	28	29
EPT richness	11	11
Biotic index	5.48	5.22
% Dominant taxon	24	26
% EPT	43	45
% Collectors (g+f)	54	68
% Scrapers + Shredders	37	25
% Hydropsychinae of Trich	77	78
Metals tolerance index	4.65	4.79
Shannon Diversity	3.45	3.68
EPT/Chironomidae	3.2	1.7
CTQa	82	84
% Baetidae of Ephemeroptera	75	44
% Coleoptera	12	8
% Diptera	6	5
% Chironomidae	13	27
% Ephemeroptera	10	9
% Plecoptera	<1	1
% Trichoptera	32	35
% multivoltine	23	30
% univoltine	61	58
% semivoltine	16	12

Functional Feeding Grp	%RA	# taxa	%RA	# taxa
Filterers	31	7	32	6
Collector-Gatherers	23	7	36	11
Shredders	0	0	3	3
Scrapers	37	3	22	2
Predators	7	8	7	6

Est. total number of organisms	1123	452
Est. number collected per foot	37	23
Est. number collected per minute	1123	452

Macroinvertebrate Taxonomic Data

EAST FORK BIG SPRING CREEK

At Comes': 100 ft. downstream from bridge	2.1		2.2			
Taxon	#	%	#	%	BI[2]	FFG[1]
MISC. TAXA						
Oligochaeta: Naididae	3	0.95	0	0	8	CG
Sphaeriidae	2	0.63	1	0.29	8	CF
Physella sp.	87	27.62	83	24.48	8	SC
TOTAL: MISC. TAXA	92	29.21	84	24.78		
ODONATA						
Ophiogomphus	1	0.32	4	1.18	5	PR
TOTAL: ODONATA	1	0.32	4	1.18		
EPHEMEROPTERA						
Acentrella	1	0.32	0	0	4	CG
Baetis tricaudatus	6	1.90	9	2.65	4	CG
Choroterpes	1	0.32	2	0.59	2	CG
Tricorythodes minutus	5	1.59	16	4.72	4	CG
TOTAL: EPHEMEROPTERA	13	4.13	27	7.96		
PLECOPTERA						
Zapada cinctipes	2	0.63	2	0.59	3	SH
Perlidae (immature)	0	0	1	0.29	2	PR
Skwala	2	0.63	10	2.95	3	PR
TOTAL: PLECOPTERA	4	1.27	13	3.83		
TRICHOPTERA						
Brachycentrus occidentalis	55	17.46	25	7.37	2	CF
Helicopsyche borealis	5	1.59	19	5.60	3	SC
Hydropsychidae (pupa)	0	0	1	0.29	4	CF
Cheumatopsyche sp.	0	0	6	1.77	5	CF
Hydropsyche sp.	22	6.98	69	20.35	5	CF
Oecetis	1	0.32	4	1.18	8	PR
Wormaldia	1	0.32	6	1.77	0	CF
TOTAL: TRICHOPTERA	84	26.67	130	38.35		
COLEOPTERA						
Optioservus	32	10.16	25	7.37	5	SC
Zaitzevia sp.	0	0	1	0.29	4	CG
TOTAL: COLEOPTERA	32	10.16	26	7.67		
DIPTERA						
Atherix	29	9.21	21	6.19	5	PR
Simuliidae (pupa)	1	0.32	0	0	6	CF
Simulium sp.	7	2.22	0	0	5	CF
Hexatoma	7	2.22	12	3.54	2	PR
TOTAL: DIPTERA	44	13.97	33	9.73		
CHIRONOMIDAE						
Cricotopus	8	2.54	3	0.88	7	CG
Eukiefferiella Brehm Gr	8	2.54	4	1.18	4	CG

Continued...

Macroinvertebrate Taxonomic Data

EAST FORK BIG SPRING CREEK

At Comes': 100 ft. downstream from bridge	2.1		2.2			
Taxon	#	%	#	%	BI[2]	FFG[1]
Micropsectra sp.	0	0	1	0.29	4	CG
Pagastia	1	0.32	0	0	1	CG
Parametriocnemus sp	11	3.49	2	0.59	5	CG
Rheocricotopus	4	1.27	0	0	4	CG
Rheotanytarsus	5	1.59	4	1.18	6	CF
Thienemanniniyia	2	0.63	1	0.29	5	PR
Tvetenia Bavarica Gr.	6	1.90	7	2.06	5	CG
TOTAL. CHIRONOMIDAE	45	14.29	22	6.49		
GRAND TOTAL	315	100.00	339	100.00		

Aquatic Macroinvertebrate Data: East Fork Big Spring Creek: At Comes', 100 ft. below bridge.

Sample:	2.1	2.2
% of sample used:	38	33
Subsample size	315	339
Taxa richness	28	27
EPT richness	11	13
Biotic index	5.19	5.09
% Dominant taxon	28	24
% EPT	32	50
% Collectors (g+f)	47	46
% Scrapers + Shredders	40	38
% Hydropsychinae of Trich	26	58
Metals tolerance index	4.27	4.09
Shannon Diversity	3.57	3.63
EPT/Chironomidae	2.2	7.7
CTQa	80	77
% Baetidae of Ephemeroptera	54	33
% Coleoptera	10	8
% Diptera	14	10
% Chirononidae	14	6
% Ephemeroptera	4	8
% Plecoptera	1	4
% Trichoptera	27	38
% multivoltine	14	12
% univoltine	57	71
% semivoltine	29	17

Functional Feeding Grp	%RA	# taxa	%RA	# taxa
Filterers	30	7	33	7
Collector-Gatherers	17	11	13	9
Shredders	<1	1	<1	1
Scrapers	39	3	37	3
Predators	13	6	16	7

Est. total number of organisms	840	1017
Est. number collected per foot	31	34
Est. number collected per minute	840	1017

Macroinvertebrate Taxonomic Data

BEAVER CREEK
At Regli's

Taxon	3.1 #	3.1 %	3.2 #	3.2 %	BI[2]	FFG[1]
MISC. TAXA						
Oligochacta: Lumbriculidae	1	0.30	0	0	10	CG
Sphaeriidae	3	0.89	1	0.33	8	CF
Physella	35	10.36	17	5.56	8	SC
Acari	1	0.30	2	0.65	5	PA
TOTAL: MISC. TAXA	40	11.83	20	6.54		
EPHEMEROPTERA						
Baetis tricaudatus	17	5.03	8	2.61	4	CG
Drunella grandis	1	0.30	0	0	2	CG
Ephemerella	1	0.30	0	0	1.5	CG
Paraleptophlebia debilis	1	0.30	0	0	1	CG
Paraleptophlebia heteronea	0	0	3	0.98	1	CG
TOTAL: EPHEMEROPTERA	20	5.92	11	3.59		
PLECOPTERA						
Amphinemura	3	0.89	0	0	2	SH
Zapada cinctipes	0	0	2	0.65	3	SH
Hesperoperla pacifica	0	0	1	0.33	1	PR
Skwala	71	21.01	36	11.76	3	PR
TOTAL: PLECOPTERA	74	21.89	39	12.75		
TRICHOPTERA						
Brachycentrus americanus	2	0.59	0	0	1	SC
Brachycentrus occidentalis	31	9.17	11	3.59	2	CF
Hydropsyche	61	18.05	81	26.47	5	CF
Lepidostoma sp.	0	0	9	2.94	1	SH
Oecetis	13	3.85	2	0.65	8	PR
Limnephilidae (imm)	5	1.48	0	0	3	SH
TOTAL: TRICHOPTERA	112	33.14	103	33.66		
COLEOPTERA						
Dytiscidae	4	1.18	0	0	5	PR
Optioservus	4	1.18	8	2.61	5	SC
TOTAL: COLEOPTERA	8	2.37	8	2.61		
DIPTERA						
Simulium	1	0.30	0	0	5	CF
Antocha	6	1.78	3	0.98	3	CG
Dicranota	1	0.30	1	0.33	3	PR
Hexatoma	13	3.85	11	3.59	2	PR
Tipula	1	0.30	1	0.33	4	SH
TOTAL: DIPTERA	22	6.51	16	5.23		
CHIRONOMIDAE:						
Brillia	1	0.30	0	0	4	SH
Cricotopus	31	9.17	37	12.09	7	CG
Cricotopus Trifascia Gr.	1	0.30	1	0.33	6	CG

Continued...

Macroinvertebrate Taxonomic Data

BEAVER CREEK

At Regli's	3.1		3.2			
Taxon	#	%	#	%	BI[2]	FFG[1]
Eukiefferiella Devonica Gr.	2	0.59	0	0	8	CG
Eukiefferiella Brehmi Gr.	14	4.14	50	16.34	4	CG
Eukiefferiella Psendomontana Gr.	1	0.30	0	0	8	CG
Micropsectra	5	1.48	4	1.31	4	CG
Microtendipes	1	0.30	0	0	6	CG
Orthocladius	1	0.30	0	0	6	CG
Pagastia	2	0.59	7	2.29	1	CG
Parametriocnemus	1	0.30	0	0	5	CG
Rheocricotopus	1	0.30	3	0.98	4	CG
Thienemannimyia sp.	0	0	2	0.65	5	PR
Tvetenia Bavarica Gr.	1	0.30	5	1.63	5	CG
TOTAL: CHIRONOMIDAE	62	18.34	109	35.62		
GRAND TOTAL	338	100.00	306	100.00		

Aquatic Macroinvertebrate Data: Beaver Creek at Regli's.

Sample:	3.1	3.2
% of sample used	63	19
Subsample size	338	306
Taxa richness	35	25
EPT richness	11	9
Biotic index	4.58	4.47
% Dominant taxon	21	26
% EPT	61	50
% Collectors (g+f)	54	70
% Scrapers + Shredders	15	12
% Hydropsychinae of Trich	54	79
Metals tolerance index	4.43	5.50
Shannon Diversity	3.75	3.49
EPT/Chironomidae	3.3	1.4
CTQa	76	71
% Baetidae of Ephemeroptera	85	73
% Coleoptera	2	3
% Diptera	7	5
% Chironomidae	18	36
% Ephemeroptera	6	4
% Plecoptera	22	13
% Trichoptera	33	34
% multivoltine	22	36
% univoltine	65	57
% semivoltine	13	7

Functional Feeding Grp.	%RA	# taxa	%RA	# taxa
Filterers	28	4	30	3
Collector-Gatherers	26	18	40	10
Shredders	3	4	4	3
Scrapers	12	3	8	2
Predators	30	5	17	6

Est. total number of organisms	541	1632
Est. number collected per foot	18	60
Est. number collected per minute	541	1632

TABLE A. Functional Feeding Groups

Abbreviation	Description
CF	Collector - filterer
CG	Collector - gatherer
OM	Omnivore
PA	Parasite
PR	Predator
SC	Scraper
UN	Unknown
SH	Shredder